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ABSTRACT

This investigation examined middle-school students' attitudes toward and abilities to benefit from small group computer-based instruction (CBI) as a function of their academic aptitudes, gender, and learning situations. Two studies were conducted with different tasks. Seventy-six seventh graders (39 high aptitude and 37 low aptitude) from a suburban school completed a task designed for individual performance; while a group of 56 students from an inner-city middle school completed a task designed for small group performance. After completing the tasks designed for individualized performance, higher ability students preferred individualized CBI and lower ability students preferred small group CBI; while the opposite set of values was found for the small group learning task. It was concluded that an aptitude-by-treatment interaction (ATI) seems to exist between students' preferences for small group or individualized CBI and their academic abilities, and that this ATI effect appears to be a function of the learning situation rather than any inherent predisposition for small group or individualized CBI. (18 references) (Author/BBM)

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Title:

Students' Attitudes Toward Small Group CBI: A Question of Aptitude

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Students' Attitudes Toward Small Group CBI:
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ABSTRACT

This investigation examined middle-school students' attitudes toward and abilities to benefit from small group computer-based instruction (CBI) as a function of their academic aptitudes, gender, and learning situations. Two studies were conducted with different tasks. Seventy-six seventh graders (39 high aptitude and 37 low aptitude) from a suburban school completed a task designed for individual performance; while a group of 56 students from an inner-city middle school completed a task designed for small group performance. After completing the tasks designed for individualized performance, higher ability students preferred individualized CBI and lower ability students preferred small group CBI; while the opposite set of preferences was found for the small group learning task. A complex interaction was then proposed among students' academic aptitudes, their preferences for small group or individualized CBI, and the learning situation.

Introduction

Foremost among many recent trends in education has been a surge of interest in cooperative learning. A computer search of the ERIC system produced 628 professional works during the last seven years on this topic as compared to 105 such works from 1965 to 1982.

Underlying this trend is the belief that cooperative learning situations can help educational programs and systems throughout the world meet some of their pressing practical concerns. For example, current economic problems have made it impossible for the U.S. school systems to have enough computers to meet the needs of every student (Becker, 1990; Sutton, 1991). These economic concerns have also led to a greater disparity in the accessibility of computers to students from affluent and poor schools with students from the latter schools having very limited access to this instructional medium (Sutton). Cooperative or small group use of computers can thus allow more students--especially those from disadvantaged communities--to use this instructional medium.

Small group learning is also expected to give students a more positive attitude toward the instructional process (Smith, 1987). Such claims about cooperative learning's enhancement of student motivation, especially that of marginal students appears throughout the educational literature (Glaser, 1985; Hooper & Hannifan, 1991; Johnson, Johnson, & Stanne, 1983; Mensch, Lew, Johnson, & Johnson, 1986; Sharan, 1990; Slavin, 1987). Hooper and Hannafin (1991) have noted that students working individually for extended periods often become lonely, bored, or frustrated with their work. Also, individualized work tends to make at-risk students feel more isolated from their peers (Mensch et al.). Small group use of computer-based instruction (CBI) should thus help students overcome these problems of frustration and isolation as students provide each other with moral support (Hooper & Hannafin; Rysavy & Sales, 1991). It is generally believed that helping students to overcome such feelings helps students to reach higher levels of academic achievement (Hooper & Hannifan; Rysavy & Sales, 1991).

An aptitude-by-treatment interaction (ATI) may exist in students' preference for small group learning (Sharan & Shaulov, 1990). Pyryt (1991) has intimated that higher ability students are more oriented toward individualistic learning situations than cooperative learning situations as these students prefer competitive activities. Lower ability students seem to prefer cooperative learning situations as these learning environments provide them

with needed structure and moral support. Hence, lower ability students would seemingly prefer and benefit from small group CBI while higher ability students would find individualistic CBI situations more beneficial.

Clark (1982) found evidence that suggests a different relationship between students' abilities and preferences toward individualistic and small group CBI. Lower ability students were found to prefer activities that promised them relative anonymity while higher ability students tended to prefer the more structured tasks. According to Clark's evidence, lower ability students would tend to favor individualistic CBI over small group CBI while the opposite preference would be found for higher ability students.

Dalton, Hannafin, and Hooper (1989) did find further empirical support for lower ability students' preference for anonymity. This investigation, which involved students' learning scientific materials, found a complex interaction among students' gender, ability levels, and preferences for dyadic or individualized use of CBI materials. Lower ability males tended to prefer individualistic CBI while their female counterparts preferred cooperative CBI. They claimed that the lower ability male students' desire for anonymity was due to the learning situation associated with their study. That is, male middle-school students did not want other students to realize that their knowledge of science was limited. The reasons for lower ability females' preference for cooperative CBI were not discussed. They also failed to mention other aspects of this learning situation, such as the composition of the groups, which might have affected the lower ability male students' desires for anonymity. Finally, Dalton et al. did not find any ATI effects in the students' achievement scores.

Except for the evidence provided by Dalton et al., very little empirical data exist regarding the possible ATI effects in students' preferences for and abilities to benefit from small group use of computer technology. Hence, many questions remain regarding such possible ATI effects, including their very existence.

Purpose of Investigation

The primary purpose of this investigation was to examine middle-school students' preferences for and abilities to benefit from either small group or individualized CBI as a function of their academic aptitudes, learning situation and gender. Also examined were the students preferences for: (a) small group CBI versus not working at the computer and (b) working with a partner versus working with partners at terminals. A final issue involved changes in the students' preferences as a function of their learning experiences. These later issues have also not been fully explored by the research literature (see Shlechter, 1991).

Research Approach

Two studies were conducted employing completely different learning situations. One group of students completed a science task designed for individualized learning with individualized measures of performance being utilized. A second group used the computer to complete a social studies task designed for small group learning. The performance measure for this study was the group's completion of the task. Also, homogeneous ability groupings were employed for Study 1 while both homogeneous and heterogeneous ability groupings were employed for Study 2.

Each study was conducted as part of the schools' academic program. All studies were also conducted during regularly scheduled class sessions in the schools' computer laboratories. The subjects were neither encouraged nor discouraged from engaging in cooperative activities. Previous studies have shown that students who are working together

at terminals are rarely instructed to engage in cooperative behaviors (see Littlejohn, Ross, & Gump 1984; Shlechter, 1991).

Study 1

Method

Subjects: This sample consisted of eighty seventh graders (40 high and 40 low aptitude) from a suburban middle-school in the greater Phoenix, AZ area. Half of these students had a high aptitude for science, as determined by teacher nominations, and the other half had a low aptitude. Four students did not complete the task leaving 39 high aptitude students and 37 low aptitude students.

Training Conditions: Subjects were assigned to one of three training conditions: small group (four per terminal), dyad (two per terminal), or individual (by themselves). While each condition had approximately the same mix of high and low ability students, students were assigned to homogeneous ability working arrangements. Students in the small group and dyad training conditions were also arranged into either same and mixed sex groupings with approximately the same number of male-male; female-female, and female-male working arrangements.

Instruments: A 13 item continuing motivation questionnaire was adopted from one previously used by Pollock (1989). Each item involved the students in responding to one of two preferences, such as:

I would prefer to work on the computer:
a. with several partners.
b. by myself.

Five of these items dealt with assessing students' preferences for: (a) small group versus individualized CBI; (b) dyadic versus quadratic terminal arrangements; and (c) small group versus not working at the computer. The remaining eight items dealt with students' feelings regarding the subject matter and regarding the use of computers.

The immediate and delayed post-tests consisted of 30 short-answer completion questions, which were previously used by Pollock (1989). She found that the different tests were psychometrically sound with KR21 reliability coefficients in the .70s.

Procedure: The students completed a CBI instructional program on tarantulas, which was previously used by Pollock (1989). This lesson contained embedded multiple-choice and short-answer completion questions. Subjects who were told to work at their own pace took approximately fifty minutes to complete this task. Subjects, individually, completed the attitudinal questionnaire and the achievement test. Six weeks later they took, individually, the delayed post-test.

Dependent Variables and Data Analyses

Preference Data: The dependent variables for the attitudinal measures were the students' responses to items dealing with small group and individualized CBI. Separate 2 X 2 chi-square analyses per item were conducted to determine the existence of any aptitude difference in these data. The cross-break variables for these different chi-square analyses were the subjects' aptitudes (high or low) by their responses to each of the two choices per item--e.g., working with a partner or by themselves.

4 X 2 chi-square analyses were also computed to examine any possible interaction between aptitude and gender. The factors for these analyses were four groups of subjects--(a) low aptitude females; (b) high aptitude females; (c) low aptitude males; and (d) high aptitude males--by response frequencies for each choice. These chi-square analyses were conducted upon the subjects' responses for working with a partner and with partners.

All chi-square tests were computed for proportional differences in the data. The computer program--SPSSx--was used to compute these tests with the alpha level being set at .05.

Performance Data: The dependent variables for these data were the subjects' scores on the different tests. These data were analyzed by the following ANOVA model--a 3 X 2 X 2 X 2 factorial for repeated measures. As previously indicated, these factors included three levels of group size (small group, dyad, and individualized CBI); two levels of gender (male and female), two levels of scientific aptitude (high and lower aptitude students); and two levels of tests (immediate post-test versus delayed post-test), which were the repeated dimension of the ANOVA model

Again, SPSSx was used to compute the analyses. And the alpha level was set at .05 for all tests.

Results

A significant relationship was found with regards to aptitude differences and students' preferences for working with a partner, X^2 (1, N = 76) = 4.53, $p < .03$). Also, a trend approaching significance was found with regards to working with partners, X^2 (1, N = 76) = 3.33; $p > .07$). Seventy percent of the lower ability students preferred working on the computer with an assigned partner rather than working by themselves. Only 46% of the higher ability subjects had the same preference. Nearly 55% of the lower aptitude students favored working on the computer in an assigned group of four as compared to only 30% of the higher aptitude students.

There was a marginally significant interaction between gender and aptitude regarding the subjects' preferences for working with a partner, X^2 (3, N=76)=7.35; $p > .06$). A substantially lower percentage of higher ability males favored working with a partner than did any other group. However, this interaction was not significant for the subjects' preferences for working with partners.

Several other interesting patterns emerge from the preference data. Subjects overwhelmingly preferred to work with a partner rather than with partners. They preferred working in small groups rather than not working at a computer. An interesting aside is that subjects--regardless of aptitude and sex--preferred to study something other than insects on the computer.

Performance Data: The ANOVA test failed to find any significant effects nor interactions associated with group size. Students thus learn and retain comparable amounts of information regardless of the CBI mode of presentation.

STUDY 2

Method

Subjects: The subjects were fifty-six (38 females and 18 males) seventh graders from Louisville, KY. The principal indicated that this sample consisted of 12 low aptitude (4

females and 8 males), 12 average students (7 females and 5 males), and 32 (27 females and 5 males) high aptitude students.

This school is located in a racially mixed working class neighborhood with a public housing project nearby. According to guidelines in the Jefferson (Kentucky) County Schools, the school has a 60-40% black-to-white ratio.

Tasks and Procedure: Several methodological changes were made from Study 1. As previously indicated, the students developed two different spreadsheets for use in a social science course. Each task took two fifty-minute class periods to complete. A second change was the matter in which the working arrangements were determined. To replicate daily computer usage, the students determined their own working arrangements for the first task. Nearly all of them chose to work with same sex partners rather than by themselves. Also, most of these groups consist of students with relatively similar academic abilities. That is, groups would rarely consisted of students with high and low aptitudes. Five students did choose to work by themselves. No systematic patterns were found in the students' desire to work by themselves vis-a-vis aptitude differences.

For the second task, students were assigned to work at a terminal with other students. This was done to force all students to work together and with classmates who were not necessarily their friends. Nearly all of the assigned groups for this task consisted of students with differing abilities and sexes.

A final set of changes dealt with the preference questionnaire. The subjects completed this questionnaire before and after completing the computer lessons. Also, the questionnaire was slightly changed to assess the terminal arrangements employed in this study. Questions about working with friends were added while those about working with a partner were eliminated.

Dependent Variables and Data Analyses: The dependent variables for the attitudinal measures were the students' responses to each item. 2 x 2 chi-square analyses were conducted for both the initial and final questionnaire data with the cross-break variables being low and high aptitudes by: (a) partners or self and (a) friends and self. Middle aptitude students who were not the focus of this investigation were eliminated for these analyses. Also, the possible "interaction" between gender and aptitude was not examined due to the limited number of females and males in the low and high aptitude groups, respectively.

The performance measure was the teacher's indications of the different groups' abilities to complete the assignment. However, it was not possible to analyze these data as the teacher indicated that all groups did complete the assignment with very little difficulty.

All chi-square tests were computed for proportional differences in the data. SPSSx was used to compute these tests with the alpha level being set at .05.

Results

A significant relationship existed in students' initial preferences toward working with friends--$\underline{X}^2$ (1, $\underline{N}$ = 44) = 4.53, $\underline{p}$ < .03--and partners $\underline{X}^2$ (1, $\underline{N}$ = 44) = 4.93, $\underline{p}$ < .03. Three-quarters of the low aptitude students had an initial preference for working with several friends rather than working by themselves while nearly 63% of the higher ability students had the opposite preference.

A significant relationship was also found for the subjects' final preferences for working with partners or by themselves, $\underline{X}^2$ (1, $\underline{N}$ = 44) = 6.38, $\underline{p}$ < .01. Nearly 70% of the higher ability students' preferred working with partners while two-thirds of the low aptitude students had the opposite preference. A comparable but non-significant trend was found for the subjects' preferences for working with friends or by themselves.

Additional chi-square analyses indicated that these reported relationships between the initial and final preference questionnaire were significant for:

(1) high aptitude student' preferences for working with friends, $\underline{X}^2$ (1, $\underline{N}$ = 64)= 7.63, $\underline{p}$ < .01.

(2) high aptitude students' preferences for working with assigned partners, $\underline{X}^2$ (1, $\underline{N}$ = 64) =5.11, $\underline{p}$ < .02.

and (3) lower aptitude students' preferences for working with assigned partners, $\underline{X}^2$ (1, $\underline{N}$ = 64) = 6.17, $\underline{p}$ < .01.

Hence, engaging in small group CBI did have a significant effect on these students' preferences for small group or individualized CBI. Several other interesting patterns emerge from these data. One, subjects--regardless of aptitude--overwhelmingly preferred to working in small groups to not working at a computer. Nearly all of them found that these exercises were either very easy or easy to complete and preferred to working with friends over working with partners. Gender effects were not found in these data.

Summary and Conclusions

Several interesting trends have emerged from this investigation's data. One, as previously described, differences were found for most measures regarding students' preferences for small group or individualized CBI. Hence, a aptitude-by-treatment interaction does seemingly exist between students' preferences for small group or individualized CBI and their academic abilities.

Two, this ATI effect does appear to be a function of "state factors" (i.e, the learning situation) rather than any inherent predisposition for small group or individualized CBI. As stated, the higher and lower aptitude students' preference data were differentially affected by the different learning situations. As found in Study 2, subjects' preferences did change as a result of engaging in small group CBI. A complex interaction might then exist among students' academic aptitudes, their preferences for small group or individualized CBI, and state factors.

This complex interaction does not seem to be contaminated by the previously discussed gender-by-aptitude interaction found in Study 1. This interaction may not have been very robust as it was a trend approaching significance. Also, comparable findings were found for Study 2's initial preference data, which included many more females than males. And, this second study dealt with examining students' preferences for working with several students rather than with a partner.

It was, however, beyond the scope of this investigation to provide any clear insights into the underlying reasons for this proposed interaction. Perhaps for the individualized learning task, the lower ability students felt that they needed help and moral support from other students whereas the higher ability students felt that other students represented competition. Higher ability students might have felt that "they could strut their stuff" in the group task while the lower ability students felt useless.

The underlying reason may have been the social composition of these groups. Study 1 was composed of homogeneous ability groupings as compared to both homogeneous and heterogeneous ability groupings for Study 2. Perhaps then, lower ability subjects felt less threatened when working with each other than when working with higher ability subjects. Correspondingly then, higher ability subjects might have felt less threatened by competition when working with lower ability subjects.

There were some indications, however, that such social factors did not totally explain the reported influences of state factors. Study 2's subjects manifested comparable preferences for working with friends and assigned partners. And these subjects were more likely to work with friends in homogeneous gender and (similar) ability groupings and with assigned partners in heterogeneous ability and gender groupings.

Whatever the underlying reasons for the proposed ATI effects, these preference data do reflect learning situations that students feel are best for them. The veracity of such feelings was not confirmed by this investigation's data. Comparable amounts of learning and retention were found across the different training conditions for the lower and higher ability students in Study 1.

This investigation's preference data can still be useful for helping educators to design their educational program. Study 1's results indicated that small group CBI should consist of dyads rather than three or four students at a terminal. Study 2's students--regardless of ability levels--preferred small group CBI to not working at a computer, which means that small group CBI can be implemented in a heavily integrated urban school. Perhaps then, small group CBI can help eliminate some of the inequities found with current computer usage in American schools.

In closing, a complex interaction appears to exist among students' academic aptitudes, their preferences for small group or individualized CBI and state factors. However, important questions regarding the underlying reasons for and possible instructional benefits associated with this interaction are left unresolved. Conceivably, further insights into these important questions will be presented at upcoming meetings of this association.

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